VIII. REASONABLE AND PRUDENT ALTERNATIVE

Regulations implementing section 7 of the ESA (50 CFR §402) define reasonable and prudent alternatives as alternative actions, identified during formal consultation, that (1) can be implemented in a manner consistent with the intended purpose of the action; (2) can be implemented consistent with the scope of the action agency's legal authority and jurisdiction; (3) are economically and technologically feasible; and (4) would, NMFS believes, avoid the likelihood of jeopardizing the continued existence of listed species or resulting in the destruction or adverse modification of critical habitat.

This Opinion has concluded that the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (Pelagics FMP) is likely to jeopardize the continued existence of the green turtle, leatherback turtle, and loggerhead turtle. The clause "jeopardize the continued existence of" means "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR §402.02).

A. Principles of the reasonable and prudent alternative

The Pelagics FMP and the fisheries prosecuted under that FMP are likely to jeopardize leatherback, loggerhead, and green turtles by capturing, injuring, and killing sensitive life stages necessary for the survival and recovery of these listed species. The magnitude of the impact on listed sea turtle populations can be estimated only in the Hawaii-based longline fishery because NMFS collects data from observers dedicated to collecting information on target species catch and incidental bycatch. The remaining fisheries under the Pelagics FMP do not have observer programs, and therefore, data on listed species interactions is often limited or anecdotal and cannot be used to confidently and quantitatively estimate impacts. Data on the U.S. purse seine fishery in the central and western Pacific Ocean is also limited at this time due to the nature of the information the observer program in this fishery collects. Many of these other fisheries may have minimal levels of interaction with listed species based on the fishing method used. However, these takes occur beyond those takes occurring in the Hawaii-based longline fishery which have been determined sufficient to appreciably reduce the likelihood of survival and recovery of leatherback, loggerhead, and green turtles. Therefore, while the takes in other Pelagics FMP fisheries could have minor impacts on their own, they exacerbate a situation already determined likely to jeopardize listed species.

As discussed in this Opinion, the Hawaii-based longline fishery threatens leatherback, green, and loggerhead turtles primarily by hooking and entangling them while the gear is soaking in the water column. A percentage of these turtles are killed during fishing operations because of prolonged submersion times and others are released alive but injured with either a hook deeply imbedded in the esophageal tissue (internal) or lightly hooked (external) with the hook and/or trailing gear removed, if there was an observer aboard. The mortality rates of turtles released alive, but injured by either being lightly hooked or having a deeply ingested hook is estimated to be 27 and 42 percent, respectively. To address the adverse effects of the Hawaii-based longline fishery that are likely to jeopardize sea turtles, management measures and other conservation measures, as necessary, must be undertaken to reduce

both the number of greens, leatherbacks, and loggerheads that are incidentally captured and injured or killed by the Hawaii-based longline fishery, and the expected impacts to Pacific green, leatherback, and loggerhead populations to such an extent that the likelihood of jeopardy is avoided and authorization of fishing activities under the Pelagics FMP can continue. In addition, the harmful effects of the other fisheries under the Pelagics FMP, which could not be fully assessed in this Opinion, must be minimized to reduce adverse impacts to captured sea turtles. Therefore, the following reasonable and prudent alternative (RPA) has been developed to avoid jeopardy for green turtles, leatherback turtles, and loggerhead turtles.

B. Development of the reasonable and prudent alternative

NMFS has analyzed the Hawaii-based longline fishery observer data on past sea turtles takes to define patterns or causes that could be addressed in an RPA and avoid the likelihood of jeopardizing the species through the continued operation of this fishery under the Pelagics FMP. Analysis of observer data for the Hawaii-based longline fishery indicates that significantly more takes of all affected sea turtle species occur within the swordfish/mixed target segment of this fishery based on the overall higher rates of interactions swordfish/mixed target-style gear had with sea turtles. Therefore, it appears that significant reductions in take levels could be achieved by prohibiting fishing with swordfish/mixed target style gear.

All remaining observed interactions occurred within the southern portion of the fishing area where the Hawaii-based longline fleet primarily fishes using tuna style gear. Based on observer data, all turtle interactions were observed in areas south of approximately 15EN, despite high numbers of observed sets in areas north of this latitude. The area south of approximately 15EN latitude may be an important foraging area for sub-adult and adult leatherbacks as well as a migratory corridor for adult female leatherbacks transiting to nesting beaches in the western Pacific. Therefore, it appears that further reductions in take levels could be achieved by closing portions of the area of expected effort to tuna style fishing.

In addition, NMFS had little available data with which to assess the magnitude of impacts to listed species from the other fisheries of the Pelagics FMP. The level of effort and the selectivity of the gear used in these fisheries has led NMFS to conclude that few takes, if any, occur in these other fisheries, but this assumption could not be confirmed with existing data. Also, the condition (e.g., hooked, entangled, dead) of any turtles captured by these fisheries is unknown, making a full analysis of any possible harmful effects to sea turtle species impossible. Therefore, NMFS has determined that a program to minimize possible harmful effects of these fisheries on captured turtles must be established.

1. Prohibit Swordfish Style Fishing Methods

Based on observer data collected from February 1994 to December 31, 1999 in the Hawaii-based longline fishery and using calculated interaction rates per set, most turtle takes were by vessels using fishing techniques to target swordfish or a mixture of tuna and swordfish. Therefore, NMFS shall prohibit longline fishing practices targeting swordfish or a mixture of targets north of the equator, by

vessels operating under the Pelagics FMP. Vessels targeting swordfish or a mixture of targets use a variety of techniques and strategies which are different than those used by vessels targeting bigeye tuna. Such differences include: (1) fishing relatively shallow (deepest hooks are fishing at a depth less than 100 meters), (2) setting fewer hooks per float (less than 10 hooks between each float), (3) attaching lightsticks to the gear to attract swordfish, (4) setting the gear without the use of a line shooter, (5) using a shorter length of float line (average 8 meters), (6) using more floats on each set (average number of floats is 189), (7) baiting hooks with squid, and (8) setting gear at night.

From 1994 through 1999, loggerhead turtles have only been observed taken by vessels targeting swordfish or mixed targets. Therefore, NMFS expects that the incidental capture of loggerhead turtles will be virtually eliminated by prohibiting swordfish-style fishing methods north of the equator under the FMP. In addition, NMFS expects significant reduction of leatherback, green, and olive ridley turtle takes by eliminating swordfish style fishing. Prohibition of this style of fishing north of the equator for vessels with Hawaii limited access permits or general longline permits under the Pelagics FMP will significantly reduce the incidental take of sea turtles because these takes appear to be related to how the gear is being set.

For loggerhead turtles, this measure is expected to almost completely avoid all future interactions with the Hawaii-based longline fishery. Therefore, NMFS believes that this measure will virtually eliminate the likelihood that this fishery could jeopardize the continued existence of loggerhead turtles. Any remaining impacts to loggerheads could occur in the tuna-style gear segment of the fishery where they might have been heretofore extremely rare. However, at this time, NMFS believes that no additional takes of loggerheads will occur in the Hawaii-based longline fishery. Therefore, should additional takes occur, NMFS will re-evaluate the expected impacts of this measure on the loggerhead turtle.

For leatherback and green turtles, this measure is expected to significantly reduce the number of interactions these species have with the Hawaii-based longline fishery based on the observed higher interaction rates these turtles had with swordfish-style gear. However, this measure alone is not sufficient to avoid the likelihood that the Hawaii-based longline fishery will jeopardize the continued existence of the leatherback and green turtles. Takes of adult and sub-adult green and leatherback turtles would still occur in the tuna-style gear segment of the fishery. Based on the current status of these two species, adult and sub-adult mortalities would be expected to reduce the reproductive success of the affected populations, which would, in turn, reduce or eliminate the population's ability to recover from its decline. This continued adverse effect on green and leatherback populations would appreciably reduce the likelihood that these species will survive and recover. Consequently, additional measures to avoid or reduce leatherback and green turtle impacts are necessary.

2. Time and Area Closures for Tuna Style Fishing

Based on past observations, immediate mortality rates of turtles caught in the tuna-style gear segment of the Hawaii-based longline fishery are very high. A possible explanation for these high immediate mortality rates could be the inability of turtles hooked or entangled in deep set tuna-style gear to reach the surface and breathe. Because additional measures are necessary to avoid the likelihood that

Hawaii-based longline fishery jeopardizes the continued existence of the leatherback and green turtles, and the immediate mortality of turtles captured in the tuna fishery appears to be high, restrictions on tuna fishing effort are necessary. NMFS shall implement time and area closures to prohibit all longline fishing south of 15° N latitude, north of the equator (0°), west of the 145°W and east of the 180° longitude between April 1st through May 31st (see Figure 11). Based on observer data from February 1994 through December 31, 1999, 67% of the leatherback sea turtles (4 of 6), 50% of green turtles (1 of 2), and 17% of olive ridley turtles (1 of 6) taken by the tuna fishery occurred in this area, primarily during the months of April and May.

The closure of portions of the tuna fishery is expected to further reduce the likelihood that the Hawaii-based longline fishery will jeopardize the continued existence of leatherback and green turtles by eliminating all of the remaining observed leatherback takes and half of the observed green turtle takes (although this latter estimate is based on a very small sample size of 2). However, due to the stratified method by which observers are placed within the fishery, NMFS is not certain that this closure will avoid all future leatherback and green turtle takes.

Effect of the Prohibition on Swordfish Style Gear and a Partial Closure on Tuna Style Gear

By stratifying the observer data by month, latitude, and deep or shallow sets (tuna style gear or swordfish style gear) to adjust for temporal and spatial biases in observer data sets and then applying this stratified matrix to the distribution of fishing effort from logbook data, the NMFS-SWFSC Honolulu Laboratory estimated the expected effect of the prohibition of swordfish-style gear and the closure of portions of the tuna-style gear fishery (D. Kobayashi and J. Polovina, NMFS, personal communication, February, 2001). Table VIII-1 contains the results of a bootstrapping approach to estimating sea turtle take reductions by prohibiting swordfish-style gear and closing portions of the tuna-style gear fishery and shifting the lost effort in the swordfish and tuna segments of the fishery into the "open" areas. Data used in this calculation included observer data from March 1994 through June 2000.

Table VIII-1. **Estimated effect of prohibiting swordfish-style gear and closing portions of the tuna-style gear fishery, including re-allocation of lost effort to "open" areas.** Source: D. Kobayashi and J. Polovina, NMFS, personal communication, February, 2001.

Species	Reduction in Turtle Interactions (%)	95% Confidence Interval (%)
Loggerhead	100	100-100
Leatherback	82	63-100
Green	85	61-100
Olive Ridley	52	9-88

Based on these results, NMFS has high confidence that the prohibition of swordfish-style gear north of

the equator will avoid the likelihood of jeopardizing the continued existence of loggerhead turtles by the Hawaii-based longline fishery. In addition, point estimates and confidence intervals for estimated reduction in take of leatherback and green turtles indicate that the implementation of both measures will have a high probability of avoiding the likelihood of jeopardy for these species. Observer data gathered after implementation of this RPA in the remaining "open" areas of the fishery should provide NMFS with additional information to assess the results of the measures. Some take of loggerhead, leatherback, and green turtles may still occur in areas outside of the closure, although NMFS has limited information at this time to assess where those takes might occur. If the observer data is an accurate representation of the distribution of takes in this fishery, we would expect that very few takes of these turtles would occur. On the other hand, if the observer data is not an accurate representation of the distribution of takes, the prohibition on gear type and the closed area may only be 63% effective for leatherback turtles and 61% effective for green turtles (Table VIII-1).

Based on NMFS knowledge of the fishery, it is expected that the closure outlined above will result in some shift of longline fishing effort to areas north of the closed area. At this point, it is speculative to predict how much effort in this area will increase, although it is possible that all effort displaced by the closure will occur in areas outside of the closure. The estimated reductions in take levels described above are based on an assumption that all effort will be displaced into the remaining open areas and gear types.

3. Limited Access Permit Restrictions

Based on NMFS' knowledge of the swordfish component of the longline fishery, it is expected that the swordfish fishing prohibition outlined above will result in some shift of swordfish or mixed target longline fishing effort to operations outside the jurisdiction of the Pelagics FMP or vessels that switch between swordfish style fishing and tuna style fishing will switch permanently to tuna fishing.

Although at this point it is speculative to predict how many vessels will shift to fishing operations not subject to the FMP, NMFS believes that vessels currently registered under the Hawaii-based longline limited access permit program could decouple their permit from their fishing vessel and continue to use fishing techniques to target swordfish and land their catch in California or other ports. These vessels could continue targeting swordfish provided no part of a fishing trip occurred inside the outer boundary of the EEZ around Hawaii. There are currently about 30 longline vessels fishing outside the EEZ off of California and making landings in California. Approximately seven of these vessels have "deregistered" or "decoupled" their vessel from the Hawaii-based longline limited access permit.

To address this possible indirect effect of the prohibition on swordfish style gear under the Pelagics FMP, disincentives for removing fishing vessels from Hawaii limited access permits or general longline permits must be implemented. Therefore, NMFS shall not allow permit owners to remove (decouple or de-register) a vessel from their Hawaii limited access permit and re-register the same vessel with a Hawaii longline limited access permit until the next permit processing period. Applications to "re-couple" or "re-register" the same vessel to the Hawaii longline limited access permit shall be processed once a year during the month of October. The month of October was chosen based on past fishing

activity of some Hawaii-based swordfish vessels that target swordfish outside the EEZ off of California from October through February.

NMFS believes that by only processing requests to add vessels to a Hawaii longline limited access permit during the month of October, it will not be practicable for vessels to take advantage of the fishing grounds off California and Hawaii since longline vessels targeting swordfish off of California could not switch over to the Hawaii-based longline fishery until the following October. If a vessel owner decides to fish without a Hawaii longline limited access permit at any time of year, then the vessel could not be added to their permit until the following October. This lack of flexibility to transfer the Hawaii longline limited access permit upon request is expected to discourage vessels from trying to avoid the prohibitions of this RPA.

These measures are necessary to insure that the impacts of Hawaii longline fishing targeting swordfish are not shifted to the California longline fishery since this would not increase the likelihood of survival or recovery of the sea turtle species. NMFS expects these measures to reduce the number of vessels that may wish to fish for swordfish part of the year from California since they will not be able to fish for tuna from a port in the western Pacific region until the following October. A fishery management plan is currently being prepared for U.S. fisheries for highly migratory species in the Pacific. Therefore, the California longline fishery will soon be managed under this plan. As necessary, this plan may also include restrictions on fishing methods in order to reduce or avoid impacts to sea turtles.

This measure, in concert with the other measures of the RPA, is expected to avoid the likelihood of jeopardy by insuring that Hawaii-based longline fishing vessels do not shift to waters off of California where leatherback sea turtle take rates are apt to be as high or higher than waters off of Hawaii. Take rates are expected to be high because leatherback turtles aggregate in Monterey Bay, California, during the summer and begin to migrate out beyond the EEZ in September. This is the same time that the longline fishing activity occurs outside or near the EEZ off California.

4. Fishing Techniques and Gear Modification Research

Recognizing that the U.S. domestic Hawaii-based longline fishery is a small segment of the total amount of longline fishing that occurs in the Pacific Ocean compared to the international fleet (e.g., Japan, Korea, and Taiwan), NMFS believes that the establishment of research to develop or modify gear technologies and fishing strategies for reducing sea turtle capture rates throughout the Pacific Ocean is needed. Developing gear technologies or fishing strategies that are capable of significantly reducing the likelihood of capturing turtles or dramatically reducing the immediate and/or delayed mortality rates of captured turtles are needed to minimize the effects of domestic and international longline fishing vessels. In order to increase the likelihood of survival and recovery of these sea turtle populations, NMFS shall focus the research community on the formation of innovative strategies and measures to diminish the impacts of commercial fishing operations on sea turtle species. As a result, by exploring these research needs, NMFS will be in a better position to lead the development and cultivation of open and collaborative dialogue between international fishing communities and creating solutions to this world wide problem.

In order to achieve this goal, NMFS shall research modifications to existing gear that (1) reduce the likelihood of gear interactions and (2) dramatically reduce the immediate and/or delayed mortality rates of captured turtles (e.g., visual or acoustic cues, dyed bait, hook type). All research funding and/or implemented by NMFS must be covered by a research and enhancement permit pursuant to section 10(a)(1)(a) of the ESA. The goal of any research shall be to develop a technology or method, via a robust experimental assessment, which would achieve the above two goals and remain economically and technically feasible for fishermen to implement.

5. Reduce the Harmful Effects of Fishing Gear Interactions

a. *Hawaii-based, American Samoa, Guam, and CNMI Longline Fisheries*

Based on information available from other longline fisheries, including the Hawaii-based longline fishery, longline fishing may have significant detrimental effects on the survival of captured sea turtles. As discussed in this opinion, longline fisheries adversely affect sea turtles by hooking, entangling, and often forcibly submerging turtles, resulting in injury or death. Under the proposed action, longline fisheries are not required to remove trailing fishing gear from captured turtles. As a result, turtles may be released with trailing gear which could further reduce their survival. NMFS is not certain of the total amount of take that may occur in longline fisheries other than the Hawaii-based longline fishery, although it is apparent that some level of take likely occurs. In addition, based on the above discussion, the prohibition on swordfish-style gear north of the equator and the closure of portions of the tuna-style gear segment of the Hawaii-based longline fishery are not sufficient to avoid all harmful effects of this fishery to sea turtles. Therefore, additional measures must be taken in the Hawaii-based longline fishery and the other longline fisheries to reduce the likelihood of harmful impacts to turtles caught in longline gear.

As per NMFS regulations [50 CFR 223.206(d)(1)], all comatose turtles that are listed as threatened under the ESA must be brought on board the vessel and resuscitated. However, vessel crews are not trained in techniques to resuscitate turtles or remove gear, nor are there observers on board the vessels outside of the Hawaii-based longline fishery to facilitate these measures. Therefore, in order to reduce the possible harmful impacts of longline gear interactions on sea turtles, NMFS shall establish or fund programs to ensure that impacts to turtles captured in these fisheries are avoided or minimized to the maximum extent practicable.

b. *Troll and Handline Fisheries*

Troll and handline fisheries may adversely affect sea turtles by hooking and entangling sea turtles, resulting in injury or death. Under the proposed action, these fisheries are not required to remove trailing fishing gear from captured turtles. As a result, turtles may be released with trailing gear which could further reduce their survival. As per NMFS regulations [50 CFR 223.206(d)(1)], all comatose turtles that are listed as threatened under the ESA must be brought on board the vessel and resuscitated. However, vessel crews in these fisheries are not trained in techniques to resuscitate turtles or remove gear. Therefore, in order to reduce the possible harmful impacts of troll or handline gear

interactions on sea turtles, NMFS shall establish or fund programs to ensure that impacts to turtles captured in these fisheries are avoided or minimized to the maximum extent practicable. These programs can include, but are not limited to: observer programs, crew training programs, or changes in fishing method or area to avoid interactions.

c. *Required Measures to Reduce the Harmful Effects of Sea Turtle Interactions*

In order to reduce the harmful effects of gear interactions on sea turtles and avoid the likelihood that these fisheries jeopardize the continued existence of loggerhead, leatherback, and green sea turtles, NMFS, at a minimum, shall implement the following measures. Additional measures based on new information about techniques to reduce injury and mortality shall be incorporated as appropriate.

1. Vessel operators and observers subject to provisions or managed by the Pelagics FMP shall be educated on sea turtle biology and on methods that will reduce injury or mortality during fishing operations.

   1A. NMFS shall conduct skipper education workshops on sea turtle resuscitation requirements, as outlined in 50 CFR 223.206(d)(1) and on gear and hook removal or disentangling techniques for all vessel operators under the Pelagics FMP.

   1B. NMFS shall include in the skipper education workshops a module of information on sea turtle biology and ways to avoid and minimize sea turtle impacts.

   1C. NMFS shall include sea turtle resuscitation techniques and sea turtle biology information during observer training.

2. Live captured sea turtles shall be released from fishing gear in a manner that minimizes injury and the likelihood of further gear entanglement or entrapment.

   2A. All sea turtles shall be removed from fishing gear or brought on deck prior to continuing with gear retrieval.

   2B. Trained personnel aboard boats fishing with hooks (longline, handline, troll, etc.,) must remove the hook from a turtle, if feasible, as quickly and carefully as possible to avoid injury or mortality. If the hook cannot be removed (e.g., the hook is deeply ingested), each vessel must carry a line clipper to cut the line as close to the hook as practicable. The line cutter must have a cutting blade capable of cutting 2.0-2.1 millimeter monofilament line and nylon or polypropylene multi-strand material commonly known as braided mainline or tarred mainline. The cutting blade must be securely fastened to a pole that is at least 6 feet (1.82 meters) in length.

   2C. Each longline vessel fishing under a general permit or limited access permit must carry a sea turtle dip net to hoist a sea turtle onto the deck, if practicable, to facilitate the

removal of the hook. The dip net must have a handle of at least 6 feet of wood, or as appropriate for vessel size, or other rigid material able to support a minimum of 100 pounds (34.1 kilograms) without breaking or significant bending or distortion and the dip net must have a net hoop of at least 31 inches inside diameter and a bag depth of at least 38 inches (96.52 centimeters) with no more than a 3 inches net mesh. Any sea turtles brought on board must not be dropped on to the deck.

2D. Each vessel fishing with hooked gear must have wire or bolt cutters aboard the vessel capable of cutting through a hook that may be imbedded externally, including the head/beak area of a turtle.

3. Comatose and lethargic sea turtles shall be retained on board, handled, resuscitated, and released according to the procedures outlined in the 50 CFR 223.206(d)(1).

3A. Vessel operators shall bring comatose sea turtles aboard, if feasible, and perform resuscitation techniques according to the procedures described at 50 CFR §223.206(d)(1) and 50 CFR §660.32(b).

3B. If an observer is aboard the vessel, the observer shall perform resuscitation techniques on comatose sea turtles.

The expected result of these measures is a decrease in the harmful effect a fishing gear interaction will have on a captured sea turtle. These measures are expected to result in lower rates of injury and delayed mortality to sea turtles captured in fisheries under the Pelagics FMP, although exact levels of reduction cannot be quantified.

C. Reasonable and Prudent Alternative

The following RPA contains four management measures which, when combined, are designed to avoid the likelihood of jeopardizing leatherback, loggerhead, and green sea turtles. The four measures are intended to operate as one alternative, not four independent alternatives.

1. Prohibit Swordfish Style Fishing Methods

NMFS shall prohibit longline fishing practices targeting swordfish north of the equator by restricting the area and manner in which longline gear is set and the quantity of swordfish that may be landed by U.S. longline vessels subject to the Fishery Management Plan for the Pelagic Fisheries of the Western Pacific Region (Pelagics FMP). These stipulations may include such restrictions or requirements on the allowable number of floats that a vessel may deploy or have on board, type of hook and bait that may be used, use of a shooter and the speed of the shooter, use of lightsticks, length of float lines and branch lines, and the number of hooks that be deployed.

2. Time/Area Closure for Tuna Style Fishing Methods

NMFS shall implement time and area closures to prohibit longline fishing to U.S. vessels operating under Hawaii limited access permits or general longline permits south of 15° N latitude, north of the equator (0°), west of the 145°W and east of the 180° longitude between April 1st through May 31st of each year.

3. Limited Access Permit Restrictions

NMFS shall not allow permit owners to remove (decouple or de-register) a vessel from a Hawaii limited access permit and re-register the same vessel with a Hawaii longline permit until the next permit processing period. Applications to "re-couple" or "re-register" the same vessel to the Hawaii longline limited access permit shall be processed once a year during the month of October. This restriction does not apply to limited access permit transfers to a new owner of the vessel or to a new vessel.

4. Fishing Techniques and Gear Modification Research

NMFS shall research modifications to existing gear that (1) reduce the likelihood of gear interactions and (2) dramatically reduce the immediate and/or delayed mortality rates of captured turtles (e.g., visual or acoustic cues, dyed bait, hook type). All research funding and/or implemented by NMFS must be covered by a research and enhancement permit pursuant to section 10(a)(1)(a) of the ESA. The goal of any research shall be to develop a technology or method, via a robust experimental assessment, which would achieve the above two goals and remain economically and technically feasible for fishermen to implement.

5. Reduce the Harmful Effects of Fishing Gear Interactions

NMFS shall establish or fund programs to ensure that harmful impacts to turtles captured in fisheries under the Pelagics FMP are avoided or minimized to the maximum extent practicable. These programs shall contain, at a minimum, the measures outlined above in Section VII.B.4.d.